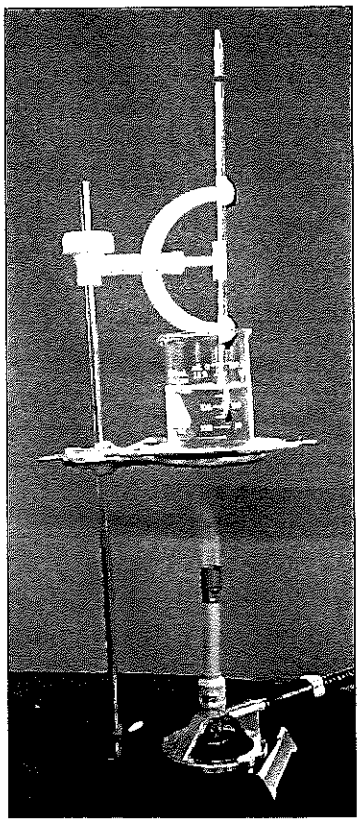
2 Explore

Name Date

Activity 1. A Watched Pot

In this activity, your group will heat ice water until it boils.

1. Fill your beaker to the 150-mL mark with ice. (The volume marks on beakers are not always accurate. In this activity, the exact amount of ice and water is not important. If an exact volume were needed, you would use a graduated cylinder.)
2. Add water to the beaker until the water line reaches the 150-mL mark.
3. Set up your heat source (Bunsen burner or hot plate) as directed by your teacher. **Do not** light the burner or turn on the hot plate yet.
4. Set up the clamp on your ring stand to hold the thermometer. The bulb of the thermometer should be submerged in the water, but should not touch the bottom of the beaker.



Bunsen burner setup.

5. In your lab notebook, set up a data table similar to the one shown on the following page. Create enough rows to allow about 25 minutes of experiment time. Under "Notes," you will record when the ice is completely melted, when bubbles appear, when the bubbles begin to rise, when the water simmers, and when the water reaches a full boil.

MATERIALS

- 250-mL beaker
- crushed ice
- water
- thermometer
- buret clamp
- Bunsen burner and striker, or hot plate
- ring stand with clamp and ring (if using burner)
- wire gauze (if using burner)
- glass stir rod
- beaker tongs
- timer or clock with second hand

Caution: Before using a Bunsen burner, secure all loose clothing and long hair.

2 Explore

Name _____ Date _____

Activity 1. (continued)

Activity 1 Data Table

Time (min:sec)	Temperature (°C)	Notes
0:00		
0:30		
1:00		
1:30		
2:00		
...		
25:00		

6. Record the temperature of the ice water at Time 0:00, and then slide the lit Bunsen burner under the beaker (or turn on the hot plate to "High"). Record the temperature every 30 seconds in your data table. Continue until the water reaches a full boil.

7. After the water reaches a full rolling boil, record the temperature for an additional two minutes, taking four more temperature measurements. Record the data in your lab notebook.

Use a glass stir rod to gently stir the water, so areas with different temperatures are mixed. Be careful and do not bump, break, or drop the thermometer.

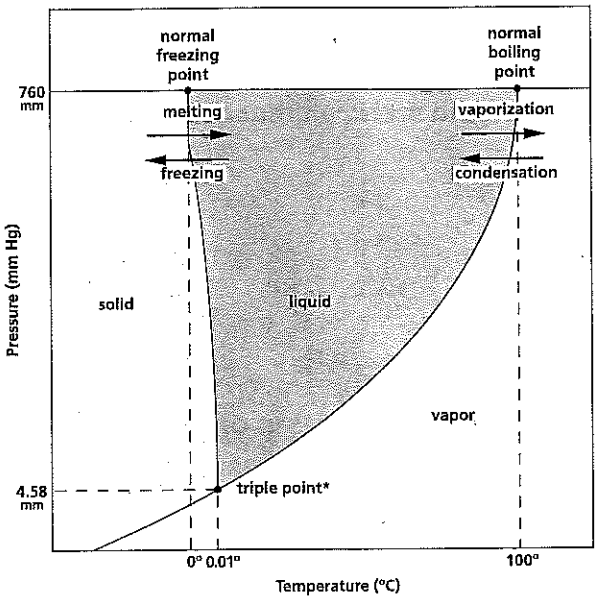
2 Explore

Name Date

Activity 2. Partial Phase Diagram of Water

1. Twist the stopcock onto the syringe. Play with the positions of the lever to find the ones that allow air to pass through the tip (open), and that seal the syringe (closed). There is a third position that allows air to exit through the side branch of the stopcock.
2. With the stopcock open, move the plunger until the black ring is at the 20-mL mark. Next, close the stopcock.
3. Right now, the air in the syringe is at the same pressure as the air in the room, but if you pull the plunger back to the 40-mL mark without unsealing it, then the pressure inside the syringe will be half the room pressure. Pushing the plunger to the 10-mL mark will make it double the room pressure.
4. Ten milliliters of hot water can be boiled in the syringe by pulling back the plunger to decrease the pressure. To do this, open the stopcock, insert the tip into the water, and then draw up the plunger until it reaches the "10 mL" mark. Next, point the tip upward and draw air into the syringe until the plunger reaches the "15 mL" mark. Close the stopcock to seal the syringe. Point the tip down and pull out the plunger until the water bubbles.
5. Use these materials to design and conduct an experiment that shows the relationship between boiling temperature and pressure. Your group should have quantitative results for at least three data points. In other words, test a portion of the phase diagram for water.

Phase Diagram for Water



*Triple point is where all three phases are in equilibrium.

MATERIALS

- 60-mL syringe
- stopcock
- 250-mL beaker
- crushed ice
- water
- thermometer
- Bunsen burner and striker, or hot plate
- ring stand with clamp and ring (if using burner)
- wire gauze (if using burner)
- beaker tongs

Caution: Be very careful when working with hot water. Be sure the syringe is pointed away from people at all times. Water over 45°C can cause burns.

3 Explain

Name Date

Activity 1. A Watched Pot

1. In your lab notebook, graph the data you collected.
2. How do your results compare to the results you expected? How would you explain any differences?
3. What aspect of your experiment could you change that would change the slope of your graph?
4. Some people suggest turning down the heat once a pot of water is boiling in order to conserve energy. They argue that so long as the water stays at a boil, lowering the heat won't lengthen the cooking time. Do you agree or disagree? Support your position.
5. What are the bubbles in your boiling water made of?

Activity 2. Partial Phase Diagram of Water

1. How do your results compare with the sample phase diagram for water?
2. Why did the water below 100°C boil?
3. Pressure canners are sometimes used to preserve food at home. How would increasing the pressure that food is cooked at help to sterilize the food?